DOCUMENT RESUME

ED 153 822 SE 024 117

AUTHOR Kubota, Carol
TITLE Tangrams: An Ancient Chinese Puzzle. A Conceptual Skill Development Kit for All Grade Levels.
INSTITUTION Washington Office of the State Superintendent of Public Instruction, Olympia.
PUB DATE 76
NOTE 35p.

EDRS PRICE MF-$0.83 HC-$2.06 Plus Postage.
DESCRIPTORS *Activity Units; Chinese Culture; Concept Formation; Elementary Secondary Education; Geometric Concepts; History; *Instructional Materials; *Manipulative Materials; *Mathematics Education; Mathematics Materials; Puzzles; *Resource Materials
IDENTIFIERS *Tangrams

ABSTRACT

A multi-subject approach to using tangram puzzles in the classroom is included along with a short history section and accompanying lessons. These lessons provide an introduction to tangrams; methods for teaching bilingual and English-dominant children concepts and skills through activities that do not require strong English skills; and activities that convey historic and cultural information, while simultaneously acquainting children with various conceptual skills. (MN)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED153822

U S DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Dorothee Brown

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM."

SE 024 117

A CONCEPTUAL SKILL

DEVELOPMENT KIT

for all grade levels

TANGRAMS:
AN ANCIENT CHINESE PUZZLE

Written and Prepared by

CAROL KUBOTA

SPI Project Consultants

Larry Matsuda

A. Barretto Ogilvie

Developed In The

Equal Educational Opportunities Section

Warren H. Burton, Director

For

Dr. Frank B. Brouillet, Superintendent

Public Instruction

State of Washington

ACKNOWLEDGEMENTS

The Superintendent of Public Instructions Office would like to acknowledge the contributions of Mr. Ron Schafer and Ms. Bettie Kan in the preparation of this booklet.

SPI
Superintendent of Public Instruction
DR. FRANK B. BROUILLET · OLD CAPITOL BLDG., OLYMPIA, WASH. 98504

November 12, 1976

This booklet attempts to provide the teacher with a multi-subject approach to using tangram puzzles in the classroom. A short history section and accompanying lessons are included.

These lessons attempt to provide:

1. An introduction to tangrams
2. Methods for teaching bilingual and English dominant children concepts and skills through activities that do not require strong English skills.
3. Activities that convey historic and cultural information, while simultaneously acquainting children with various conceptual skills.

By no means are the enclosed lessons meant to be complete or definitive. Primarily they serve as springboards to other exercises or as ideas for supplementary extra credit assignments.

Lawrence Matsuda
Asian American Program Administrator
Equal Educational Opportunities

A. Barretto Ogilvie
State Bilingual Consultant
Equal Educational Opportunities

Warren H. Burton, Director
Equal Educational Opportunities

Dr. Jack Frisk, Deputy Superintendent
Public Instruction

CONTENTS

	PAGE
Introduction	1
History	1
Tangram Design Pattern	3
LESSON I: Getting Acquainted With Tangrams	5
LESSON II: A Little Tangramath	13
LESSON III: Art	18
LESSON IV: Really Puzzling Puzzles (Logic)	26
Bibliography	30

INTRODUCTION

The tangram is an ancient puzzle which probably originated in China several thousand years ago. It was introduced to the West in the 1800's where it was known as the "puzzle of seven clever pieces". These geometric pieces, sometimes elaborately constructed out of ivory or lacquered wood, consisted of 5 triangles, 1 square and 1 parallelogram. The puzzle involved manipulating these seven shapes into literally thousands of patterns of people, animals, objects or geometric figures.

Students can benefit in many ways from the use of these concrete, manipulative shapes. Several relate to areas of mathematics, art and scientific thinking. Using the Tangram pieces can also contribute to the development of psycho-motor and logical thought processes.

References to Asian culture are included wherever possible and it is hoped students will learn not only the concepts and skills Tangrams can facilitate, but also that they will come to appreciate a unique culture. The cultural tidbits included are representative of China's historical past and are not meant to be descriptions of either Chinese-American culture or of Chinese culture today.

HISTORY

Nothing is known about how Tangrams originated. It is quite possible that the name, Tangrams, comes from combining "gram", a common ending denoting something written or drawn and "T'ang" which refers to the T'ang Dynasty, one of the greatest in Chinese history. The T'ang Dynasty existed from 618 - 906 A.D. and during this period literature and art flourished and printing was developed in China. Chinese civilization came into full

bloom during this period and the age of the T'ang Dynasty is sometimes referred to as the Golden Age of China.

Although there is little historical factual information regarding Tangrams, there is much historical fiction. In the early 1900s, Sam Loyd published a book entitled The 8th Book of Tan, which contained hundreds of Tangram puzzles. According to Loyd, there were seven previous books of Tan compiled in China 4000 years prior to the eighth book. He reported that one set of these books was printed in gold leaf upon parchment located in Peking. He also reported the existence of these books as very "rare" - obviously since he made up the whole story.

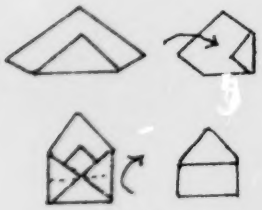
Another myth regarding the origin of Tangrams deals with an ancient Chinese nobleman named Tan who possessed a valuable square ceramic tile. One day he dropped this cherished tile and it broke into seven pieces. Tan spent the rest of his life attempting to refit the seven pieces back into the original shape. In the process he created hundreds of other shapes but not the original square.

It is fact, however, that the Chinese enjoyed the Tangram puzzle and made up many designs. Some of the designs appeared in print in 1813 and 1823 when two tangram books were published in China.

PREPARATION

Tangrams are very personal things. Each child should have his/her own set. Teachers can duplicate the pattern on the next page and have your students cut their own seven pieces from it. Cardstock or plastic works best and lasts longer than paper. You might provide envelopes to help keep pieces from getting lost. Or you might have them construct their own.

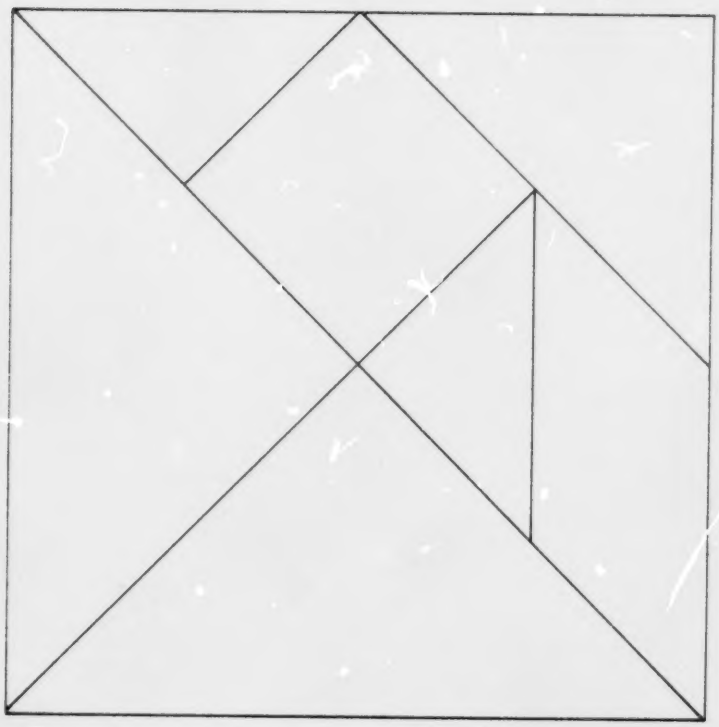
Example:
Chinese Folded Pocket



Roll

Tuck In

All lessons in this packet are intended to serve as beginnings. Use them as starting places for ideas. You will, no doubt, develop activities of your own and you will probably receive good suggestions from your students. There are several excellent books available with activities using Tangrams and these are listed in the bibliography.



LESSON 1: GETTING ACQUAINTED WITH TANGRAMS

Recommended age level: all ages

Skills and concepts:

Students begin to recognize basic shapes and forms.

Manipulative skills are increased.

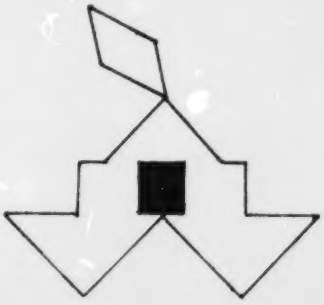
Students begin to recognize spatial relationships between the puzzle pieces.

Students are generally motivated to work at harder puzzles if they succeed early. Since it is easier to work within an outline, it is wise to duplicate the silhouettes included and have the students fit their Tangram pieces inside the puzzle. This will also help the student who finds it difficult to transfer a small image into a large picture. They will obtain practice with that concept later - for now, it is important that they exerience success.

PROCEDURE:

After the students have their pieces cut apart, give them all one or two silhouettes. Ask them to fit all their pieces within each puzzle outline. A short narrative of the puzzle is included to provide some brief background information.

Helmet



In the past Chinese soldiers wore helmets of this type with a feather waving from the top. (puzzle illustration on p. 7)

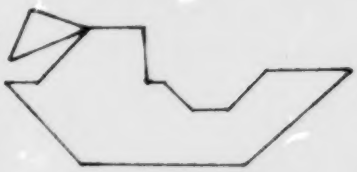
Feather Tube

This tube protected the long feathers on the ceremonial dress helmets of Chinese generals. These helmets are often very conspicuous in pictures of scenes from Chinese operas which frequently included generals. (puzzle illustration on p. 8)

Goldfish

Originally, goldfish came from China. They were later introduced in Japan where the raising of goldfish and carp (a large species of goldfish) became an art. Goldfish are a symbol of longevity to the Japanese - you may have seen kites in goldfish form from Japan. (puzzle illustration on p. 9)

Dragon Boat



On the fifth day of the fifth month, the ancient Chinese celebrated the Dragon Boat Festival. River boats were decorated to resemble floating dragons and raced up and down the river. (puzzle illustration on p.10)

Mulberry Hook

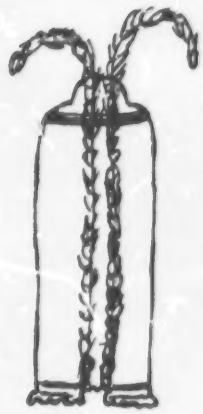
These hooks were used for cutting and trimming mulberry bushes and trees. Mulberry leaves constitute the staple of the silkworm diet and it was the Chinese who first discovered the secret of making this luxurious fabric. (puzzle illustration on p.11)

As the students finish each puzzle, let them work on another. By the time they have finished all five puzzles, they should be well acquainted with their puzzle pieces. At this point, you may wish to do MORE activities or stop and continue into the other lessons.

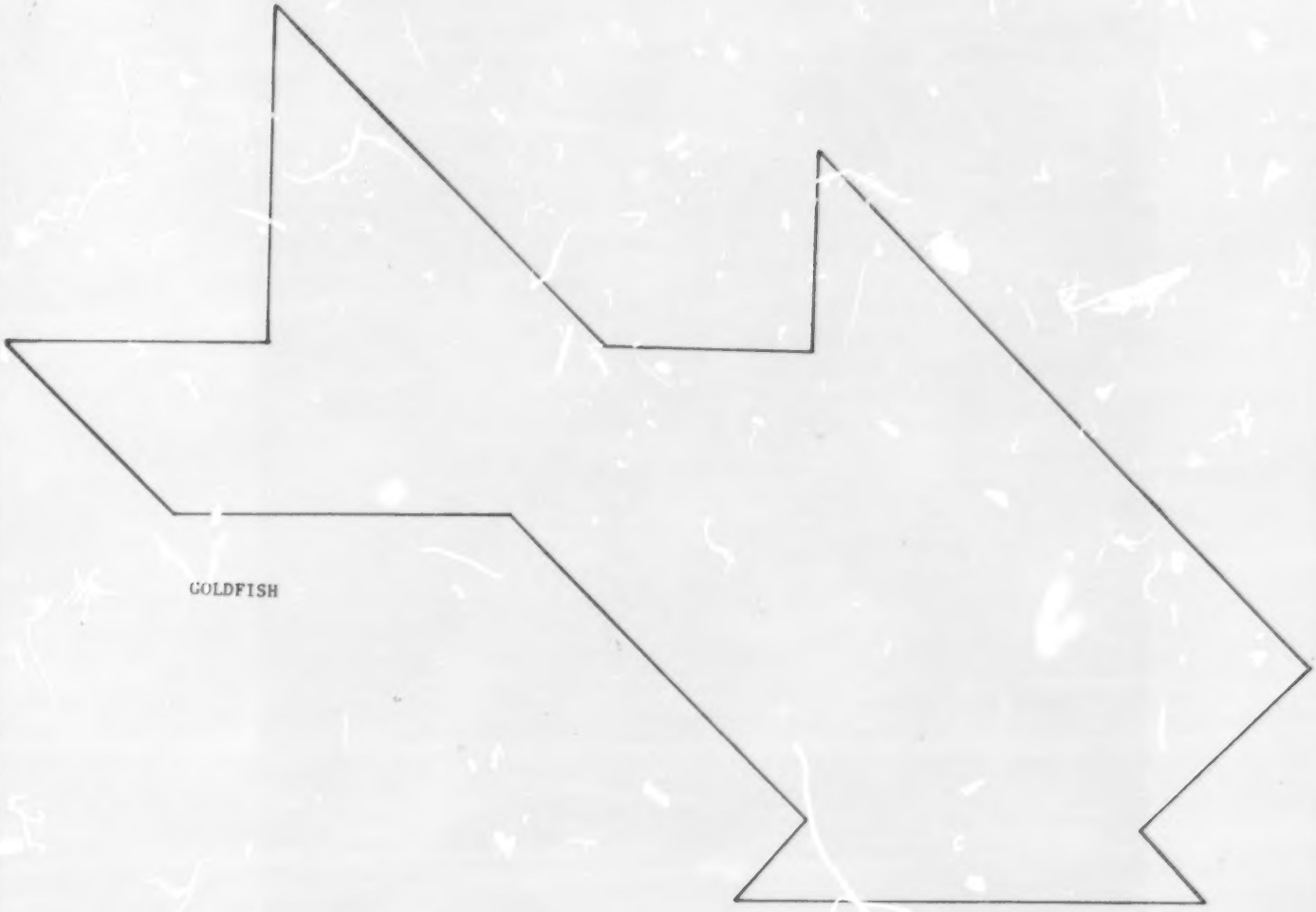
MORE:

- Have the students make up their own designs, draw around the silhouette and ask a classmate to fit his/her own pieces into the new puzzle.
- Have the students try making the shapes on page 12 .

HELMET

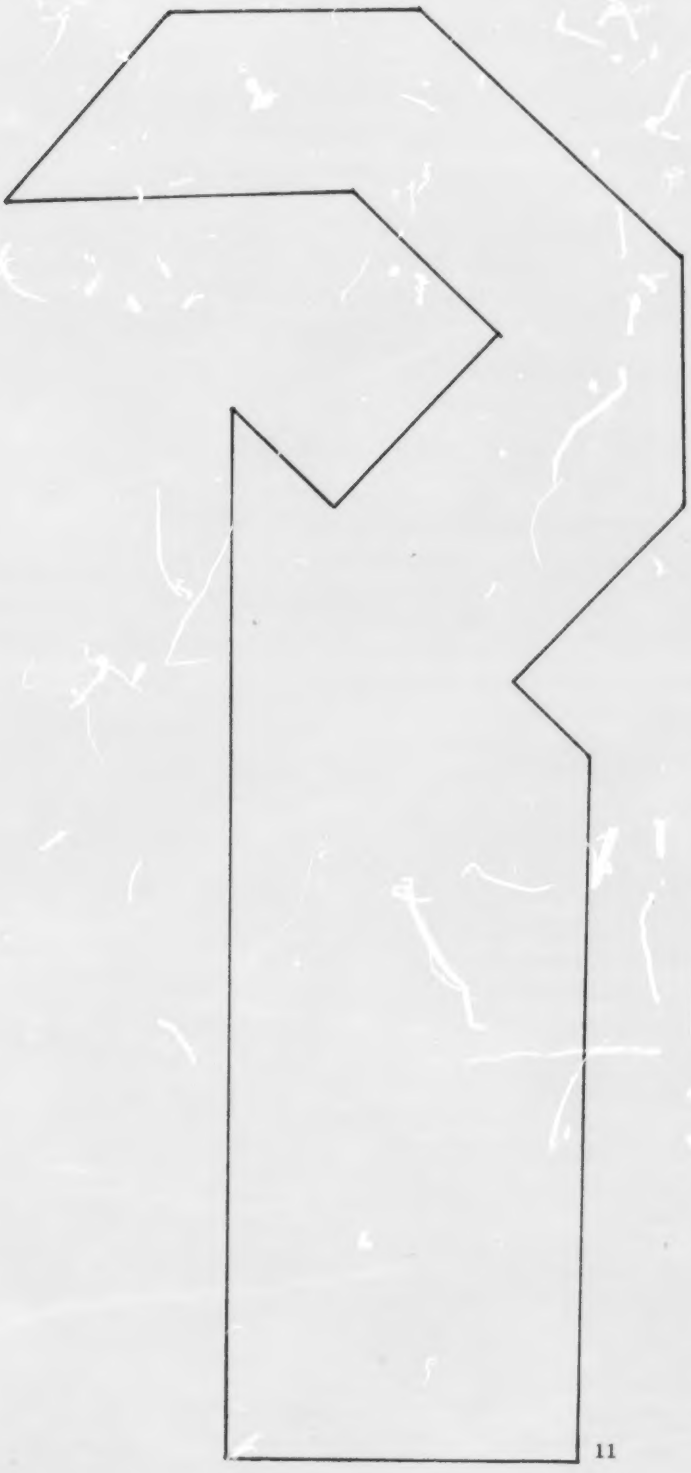


FEATHER TUBE



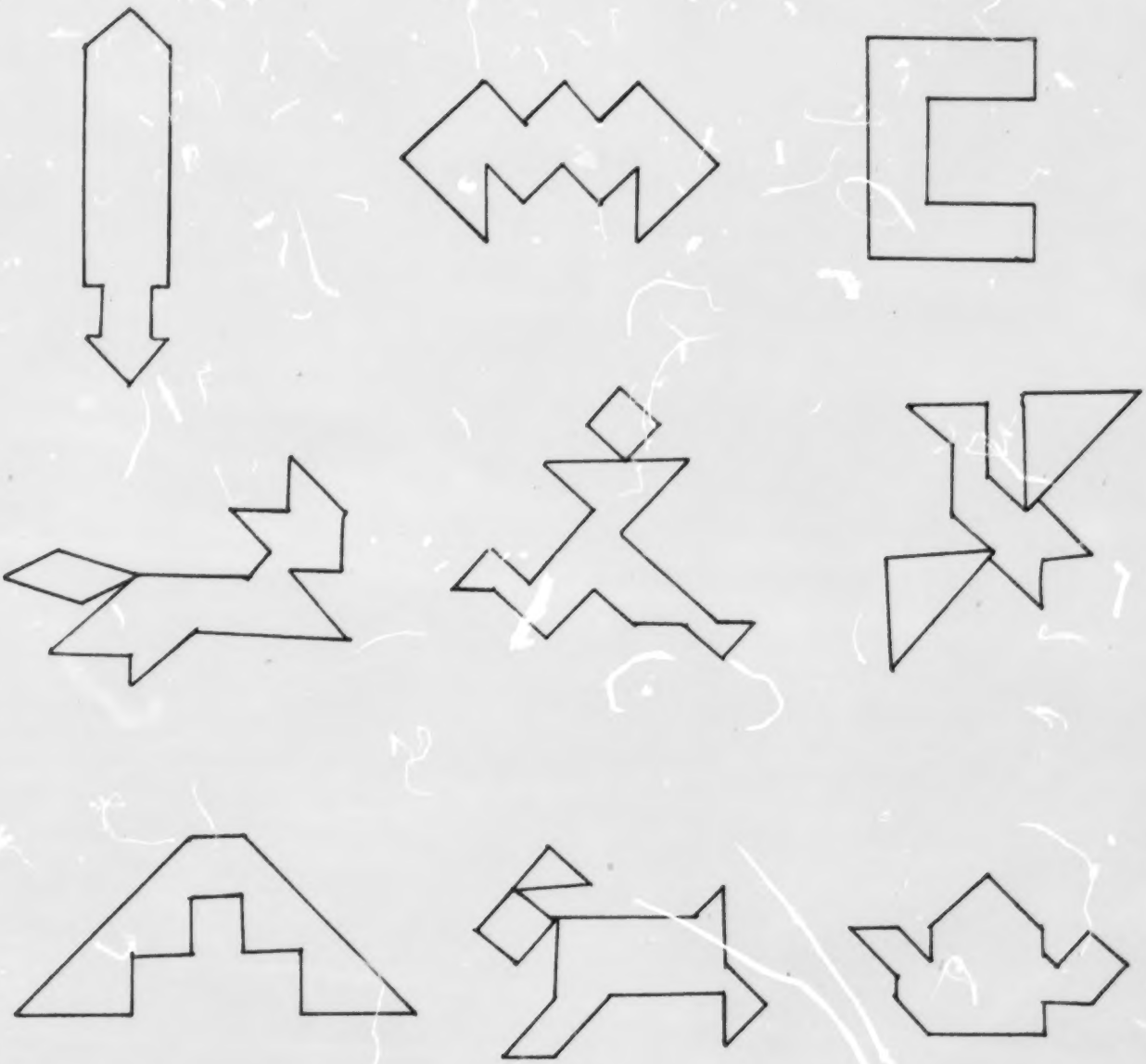
GOLDFISH

DRAGON BOAT



MULBERRY HOOK

11



18

LESSON II: ALITTLE TANGRAMATH:

Recommended age level: 9 - 14 years

Skills and Concepts:

Students come to know the Tangram shapes by their names.

Fractional relationships (relative areas) of the pieces become more apparent to the student.

Students become more aware of the similarities and differences between the pieces.

The concept of Conservation of Size is introduced (the same area can occupy different shapes and therefore these shapes are the same size).

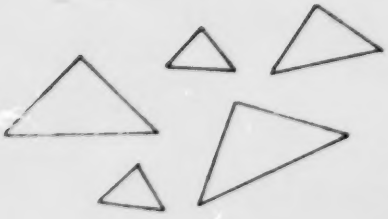
PROCEDURE:

Ask the students to sort the Tangram pieces by shape. They may form sets such as these:

All 3 sided shapes (triangles)

All 4 sided shapes

-OR-



All 3 sided shapes (triangles)

Square

Rhombus

Talk about their sets and introduce the names of the pieces. Next ask the students to sort their shapes by size. You will probably get various responses to this request. If you get a response like the one below (chances are very good that you will), run the students through the series of puzzles on the next page.

Large triangles Small triangles Medium triangle Rhombus Square

Conservation of Size may be a difficult concept for students to grasp. The idea that the same area can occupy different shapes and these shapes are, therefore, the same size is fairly sophisticated. Don't push this Conservation of Size concept - if the students still insist that the rhombus, the square and the triangle are different sizes, let it go. They are still becoming familiar with the names of the shapes and the puzzle itself.

Another approach to introducing Conservation of Size is to ask your students how may different ways they can make the large triangle. If they have trouble finding more than one way, use the worksheet on page 20. You can slip in some work with fractions by asking them how many little triangles they would need to make the big triangle.

The most difficult puzzles to solve are the polygons. It is interesting that a rhombus, a triangle and a square can be formed using all the pieces. Challenge students to make these shapes - each time using all seven pieces.

If they have difficulty, use the silhouettes provided. One other shape, the rectangle, is also included. Remind students that it is all right to flip the pieces over. (HINT: you should try these polygons yourself. Notice that once you form a triangle from the 5 smaller Tangram pieces, you need only change the positions of the large triangles to obtain any of the polygons. Some bright student may catch this. Did you?)

MORE MATH:

- Mathematical ideas of congruency and symmetry might be introduced with the Tangram pieces. Possibilities:
  What angles are congrunet with the angles of the square? triangle? rhombus? Are any of the edges of the pieces congruent (the same length)? How many lines of symmetry does a piece have? How many ways can a piece fit into its "box"?
- Fractions can be an integral part of Tangrams. Ask students how much of the square (rhombus, large triangle, medium triangle) the small triangle covers.

Can you make the medium triangle from two other pieces?

Can you make the square from two other pieces?

Can you make the rhombus from two other pieces?

Trace the two pieces you used to make the medium triangle, the square and the rhombus. What can you say about the medium triangle, the square and the rhombus?

LESSON III: ART:

Recommended age level: 9 - 12 years

Skills and concepts:

Students are introduced to art forms, design and patterns.

Development of psycho-motor skills.

BACKGROUND:

The Chinese have a rich art heritage. While the Chinese civilization is not the oldest in the history of mankind, it is the oldest civilization still in existence. Older civilizations such as the ones that thrived in Babylonia, Egypt and along the Indus River Valley have long since crumbled.

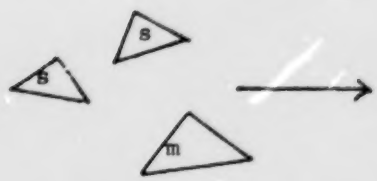
While Europe was emerging from the Dark Ages, art, sculpture and printing were flourishing in China during its Golden Age. By the time the first settlers arrived on the shores of America, the Chinese were manufacturing delicate and elaborate merchandise of wood and ivory. They invented silks, paper money, porcelain, lacquer and even the compass which helped the Europeans cross the oceans to their new home.

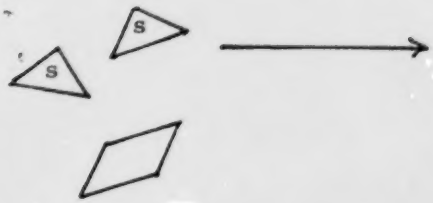
The intricate and colorful etchings found on many Chinese boxes and other objects is a small sample of the richness of their art. Many of the bronze pieces of early Chinese history were covered with simple but elegant geometric patterns. Similar designs were used to decorate floor tiles for courtyards and interiors. In this lesson, students form their own patterns for tiles from tangram pieces.

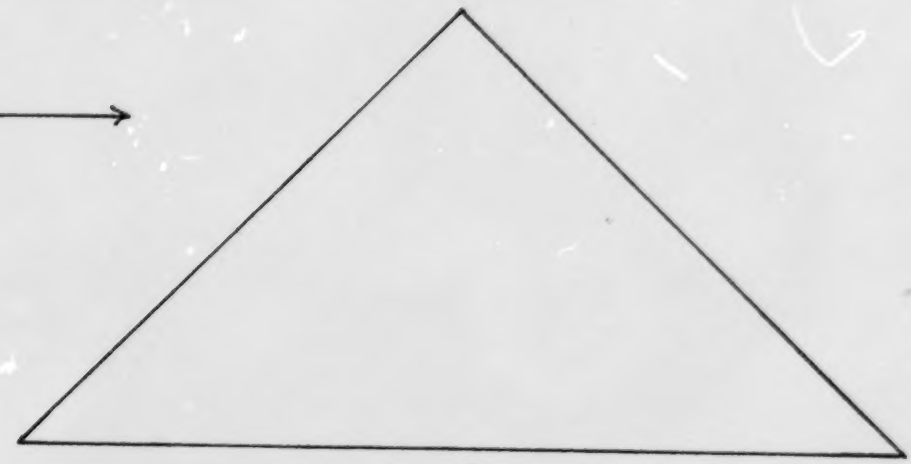
PROCEDURE:

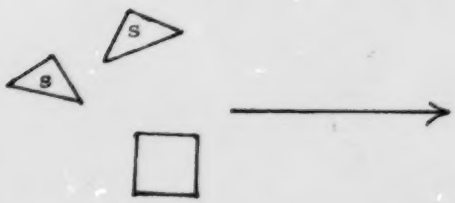
Students will need plastic, tagboard or cardstock Tangram pieces, crayons and butcher paper. Familiarize students with the method of crayon rubbings.

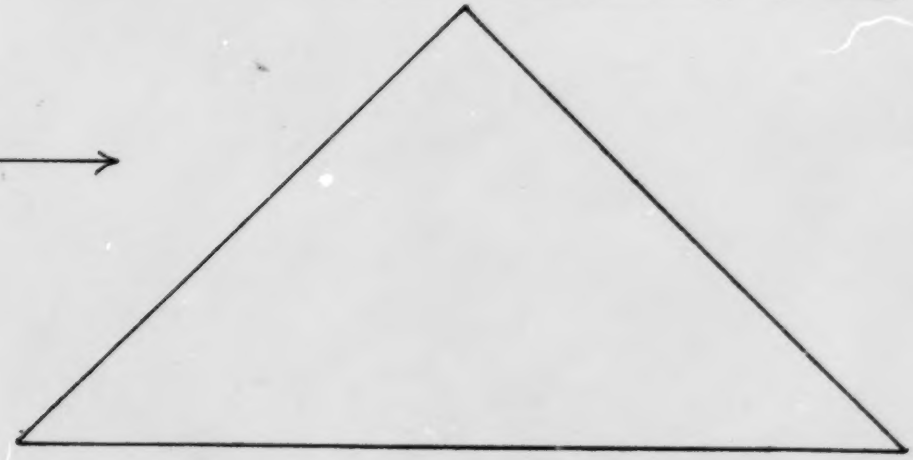
Ask them to "tile a floor" or create a repeating pattern using Tangram pieces. They may choose to "tile their floor" using one piece (show them how they can use one piece over and over by moving the piece under the paper and rubbing the crayon on the paper over the piece. They will find that any of the 3 or 5 sided shapes will tile a floor. (See examples).

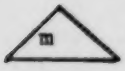


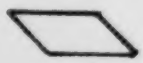


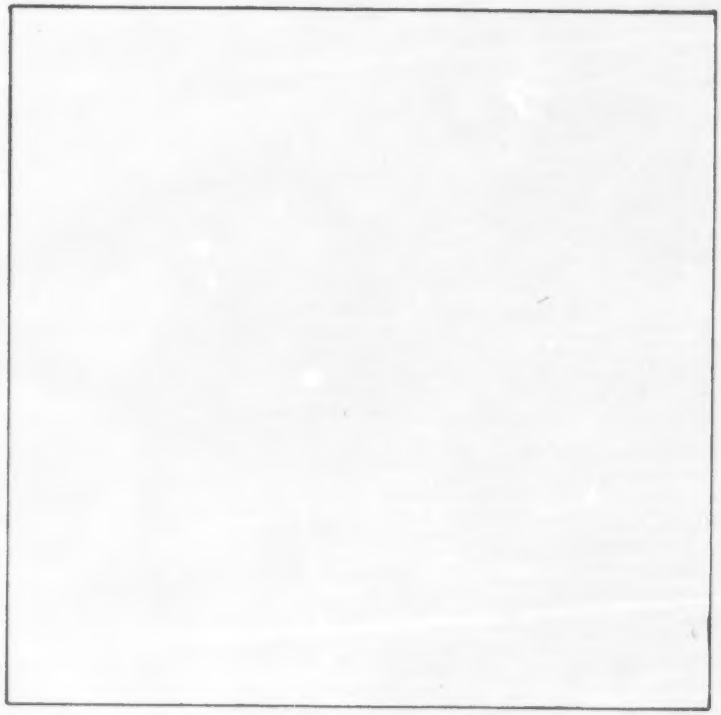






What can you say about 26 

, ,  ?



SQUARE

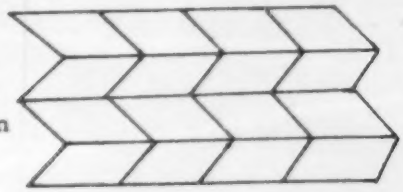
RECTANGLE

RHOMBUS

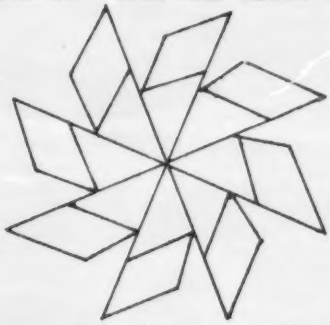
23

They may also choose to use more than one piece to "tile the floor". (See examples).

One Piece Pattern



Two Piece Pattern



Different colors in the patterns will produce some striking results. Encourage exploration of patterns and colors. They will discover that certain edges "fit together" (are congruent), and that angles seem to "fill up each other" (all Tangram angles are 90°, 45°, or 135°.)

Rather than "tiling a floor" you may wish to have students simply create designs using the Tangram pieces.

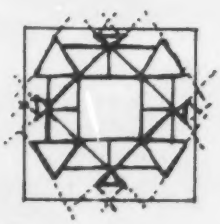
MORE:

- Any 3 or 4 sided shape - even an irregular one - will tile a floor. Have students cut some irregular 3 or 4 sided shapes to see if it really works.

- Challenge students to find out if 5, 6 or 7 sided shapes will tile a floor.

- Have students research Chinese art and try to dupli te some designs with their Tangram pieces.

- Make a self-contained tile.



LESSON IV: REALLY PUZZLING PUZZLES (LOGIC):

Recommended age levels: 10 - 15 years

Skills and concepts:

Students will be able to accurately reproduce a larger version of a small picture.

Students logical thinking processes will be developed.

BACKGROUND:

Legend has it that the first Chinese dynasty began 4000 years ago and was called the Hsia Dynasty. There are no known remnants of this dynasty. Remains have been found of what is considered to be the second dynasty - the Shang Dynasty which controlled China from 1766 B.C. - 1122 B.C. Chinese history records a total of 25 dynasties ruling China - some for as little as 15 years and some for as long as 8 centuries. The name China is derived from the Ch'in Dynasty which, although very short-lived, destroyed the existing system of independent states, established a centralized monarchy and created the extensive Chinese Empire 2000 years ago. (Dynasty refers to a royal family which hands down its rule from one member to another).

The Chou Dynasty (1122 B.C. - 256 B.C.) ruled the longest in Chinese history - 8 1/2 centuries. During the last few centuries of the Chou Dynasty, the thoughts of a man named Confucius had considerbale effect on the Chinese. Some people say that Confucianism influenced the lives of more people than any other body of thought in all history. Born in 479 B.C., Confucius taught an ethical system, a way of thinking that ushered in the Age of Philosophers for the Chinese people. The development of the Spirit of Inquiry resulted in great schools of philosophy and thought.

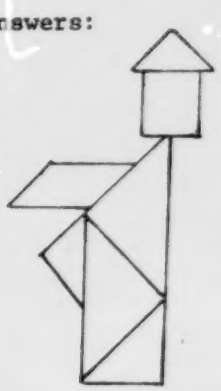
Of course, Tangrams were not invented yet but perhaps the type of paradoxical puzzles which can be derived from Tangrams would have interested some of these philosophers so concerned with the development of logical thinking. This lesson presents some of the paradoxes found in the Tangrams puzzles.

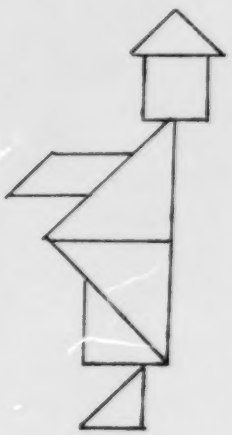
PROCEDURE:

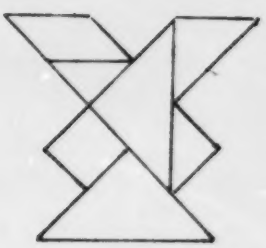
If the students have not yet reproduced small puzzles with their Tangrams, they should first try the last page of Lesson 1 before they attempt these more difficult puzzles.

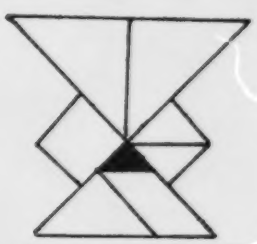
When the students are fairly proficient at solving puzzles from a given picture, they are ready to try the really puzzling puzzles on the following page. You can duplicate this page or make an overhead transparency for the class.

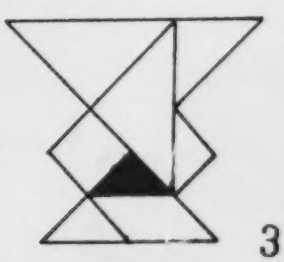
*If you must have the answers:

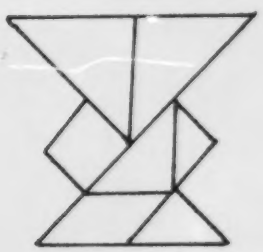




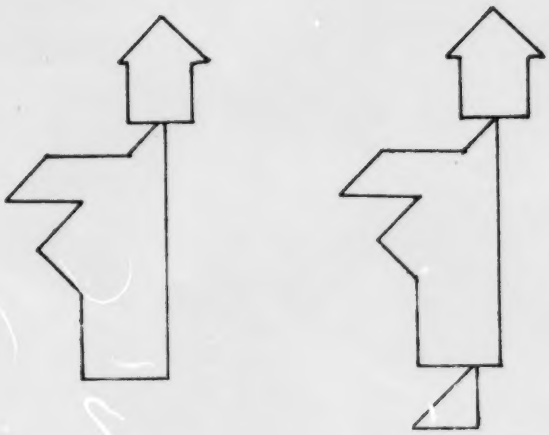




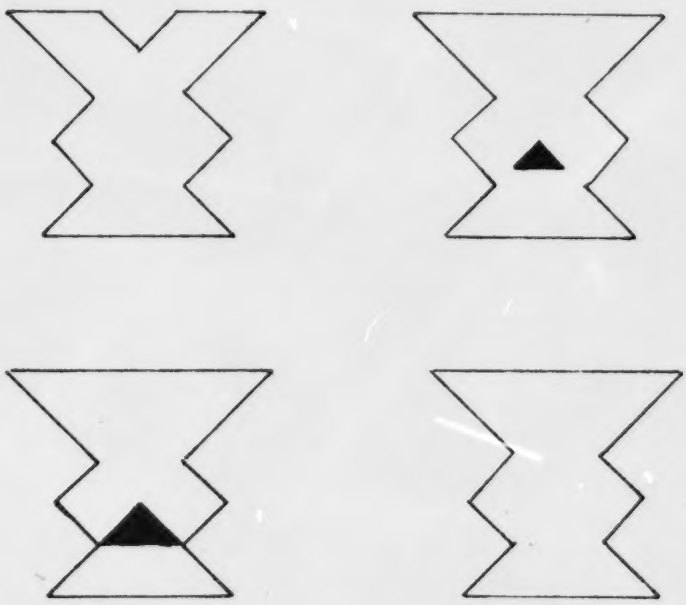




REALLY PUZZLING PUZZLES



These two men appear to be similar except that one has lost his foot. Can you put both men together using <u>all seven</u> of your Tangram pieces for each Man?



All four of these vases seem to be the same size. But one is chipped and two have holes - but of different sizes. Can you solve each puzzle and make the vases with all seven of your Tangram pieces each time?

ON YOUR OWN:

The lessons and activities in this pamphlet served as introductions to Tangrams.

For more information refer to the following bibliography:

BIBLIOGRAPHY:

A. More Tangram Puzzles

1. Tangrams 330 Puzzles
   Ronald C. Read
   Dover Publications, Inc., New York

   Available at Pacific Science Center Book Store

2. The Eighth Book of Tan
   Sam Loyd
   Dover Publications, Inc., New York

   Available at Pacific Science Center Book Store

B. Using Tangrams As A Teaching Tool

1. It's A Tangram World
   Lee Jenkins and Peggy MeLean
   Educational Science Consultants
   Los Gatos, California

2. Math Experiments With The Tangram
   Dr. John L. Ginther
   Midwest Publications Company, Inc.
   Troy, Michigan

3. Tangramath
   Dale Seymour
   Creative Publications
   Palo Alto, California

C. Tangram - A 3 minute color film

Available through the Washington State Film Library c/o The Evergreen State College, Olympia, WA 98504. (No charge)

D. Asian Culture and History

1. China
   Hyman Kublin
   Houghton Mifflin Company
   Boston, Massachusetts

2. Asian Cultures
   Paul Thomas Welty
   J.B. Lippincott Co.
   Phil. and New York